Kigozi, J., Jowett, S., Lewis, M., Barton, P. M., & Coast, J. (2017). Valuing productivity costs using the friction cost approach: Estimating friction period estimates by occupational classifications for the UK. *Health Economics*, *26*(12), 1862-1868. https://doi.org/10.1002/hec.3513

Health Economics

VALUING PRODUCTIVITY COSTS USING THE FRICTION COST APPROACH: ESTIMATING FRICTION PERIOD ESTIMATES BY OCCUPATIONAL CLASSIFICATIONS FOR THE UK

Jesse Kigozi, PhD[1]; Sue Jowett PhD[1]; Martyn Lewis PhD[2]; Pelham Barton PhD[1] ;Joanna Coast PhD[3]

[1]Health Economics Unit, Institute of Applied Health Research, University of Birmingham B15 2TT

[2]Arthritis Research UK Primary Care Centre, Primary Care Sciences, Keele University, Staffordshire ST5 5BG

[3]School of Social and Community Medicine, University of Bristol, Bristol, BS8 2PS

Address correspondence to:

Jesse Kigozi, Health Economics Unit, School of Health & Population Sciences, University of Birmingham B15 2TT, United Kingdom.

E-mail: j.kigozi@bham.ac.uk

Keywords: friction cost approach, friction period, vacancy duration, productivity costs, and lost productivity.

SUMMARY

The friction cost approach has been proposed as an alternative to the human capital approach in estimating productivity costs. However, it is difficult, in practice, to apply this approach due to limited availability of context specific data. Using national and firm level data on vacancy durations sourced from four organisations, we estimated vacancy durations, and consequently length of friction period for the United Kingdom disaggregated by occupational classification. We found comparable estimates to previously reported friction periods elsewhere. The disaggregated friction period analysis confirmed occupational class has an effect on the estimated length of the friction period. The research presents estimates on vacancy durations, and friction periods necessary to use the friction cost approach in a practical way in economic evaluations.

1. INTRODUCTION AND BACKGROUND

The friction cost approach was pioneered by health economists in the Netherlands to contribute to the growing debate on how best to estimate productivity costs in economic evaluation (Koopmanschap and van Ineveld, 1992; Koopmanschap et al., 1995; Liljas, 1998; Sculpher, 2001). This approach limits productivity losses to a friction period, with friction costs broadly comprising lost production during the friction period and the costs of hiring and training new individuals (Koopmanschap and Rutten, 1996). The friction period is a parameter that is used to limit productivity loss to the period required to restore production levels within an organisation as a result of reduced productivity due to illness (Koopmanschap and van Ineveld, 1992; Koopmanschap and Rutten, 1996). It has been argued that this approach generates more realistic estimates of productivity loss than the traditionally used human capital approach, particularly if replacement of workers by labour reserves is possible (Koopmanschap et al., 1995).

In spite of notable advantages in generating more realistic costs when using the friction cost approach, a recent review shows that few studies have applied the friction cost approach within economic evaluations in countries outside the Netherlands setting (Kigozi et al., 2016). This could be attributed to the absence of relevant and reliable data necessary for its application, with particular reference to the friction period, for which there are no ready and reliable estimates outside the Netherlands (Koopmanschap et al., 1995; Pritchard and Sculpher, 2000). The duration of a vacancy has been suggested as a proxy for estimating a friction period (Brouwer and Koopmanschap, 2005). This is the period employers take to successfully fill an employment vacancy (van Ours and Ridder, 1991).

To date, little is known about vacancy durations and how these can be used to generate friction period estimates. An important challenge for any method to become widely used is

whether there are data and tools for its practical application in any setting. We explored this issue for the UK setting. To date, only four UK studies, (Beaumont, 1978; Roper, 1988; Adams et al., 2002; Andrews et al., 2008) have explored aspects of vacancy data. However, they do not provide the sort of information required to estimate the friction period for use in productivity cost valuations and as much of these data are relatively old, they also do not illustrate current labour market conditions. More generally within the international literature, economic evaluations that have included productivity costs based on the friction cost approach, have tended to use a single average friction period. This ignores differences between types of employees in the labour market, and thus could potentially lead to inaccurate estimation of productivity costs (Koopmanschap et al., 1995; Koopmanschap and Rutten, 1996). A stratification of friction periods by individual subgroups based on education status has been conducted (Koopmanschap et al., 1995), and some occupation- specific friction period estimates reported outside the UK context (Hanly et al., 2015), but as yet, there has not been a comprehensive stratification based on occupational status. However, occupational status is often collected in economic evaluation studies and is clearly more directly relevant to vacancy durations and hence friction periods (Andrews et al., 2008). In this study, we aimed to estimate average duration of vacancies in the UK, and consequently assess the impact of occupational classifications on the estimated friction period in the UK.

2. METHODS AND DATA

Data for this study were sourced from four different organisations within the UK spanning the period 2007-2011 and represent more recent up-to-date national data. The first source was the office of National Statistics (ONS), for which data on a range of national statistics is routinely collected including vacancy duration data

(http://www.nomisweb.co.uk/default.asp). The second source was a survey from the Chartered Institute of Professional Development (CIPD), the largest human resource professional body in the UK. The organisation previously collected human resource vacancy duration statistics data through annual surveys (CIPD, 2009; CIPD, 2008; CIPD, 2007). A third organisation, DLA Piper firm, a global law firm that offers a human resource (HR) measurement and benchmarking service and collects performance data on a range of indicators from over 400 contributing organisations was also identified and surveyed for data on vacancy duration data (DLA PIPER, 2012). Finally, vacancy duration data statistics were purposively collected from the University of Birmingham human resource department as part of a primary data collection exploration process. In each case, respondents for the organisation were asked for the time taken to fill a vacancy, grouped by relevant standard occupational classification categories.

As part of the analysis, data from the four organisations were standardised to ensure a uniform length of the friction period and standard occupational classification categories. The standard period considered for this analysis was the average period taken to fill a vacancy, from when a vacancy is raised to when an individual actually starts working in the position. To ensure comparability between the datasets, each friction period estimate was based on the average vacancy duration plus an additional period of four weeks, in line with previous literature (Koopmanschap et al., 1995; Kigozi et al., 2016) in order to the cover the full length of a friction period for all datasets. This period was added to allow for recruitment, successful uptake of a position and necessary training following replacement as this was not captured in the DLA Piper and ONS datasets.

In order to make the findings more representative of the overall UK working population, a grossing weighting factor of the total number of vacancies nationally in each occupational

class for each year covering the period 2007-2011 was applied to the vacancy duration estimates obtained using the weighted average statistical analysis technique. Grossing is the process of applying a factor(s) to survey sample data in order to yield estimates applicable to the overall population. The grossing factors were applied for two reasons: first to ensure compensation for survey design, i.e. over sampling of some occupations and under sampling others, and second to take account of any non-response bias, i.e. survey rates achieved for different occupational classifications. The standard occupational classification weights were derived from the UK Office of National Statistics (ONS). ONS labour force survey (http://www.ons.gov.uk) data were considered appropriate for this adjustment as they provide the largest annual comprehensive national estimates of jobs across the entire UK economy. Finally, the adjusted data from the four data sources were pooled together to generate an overall average friction period.

3. RESULTS

The sample considered was broadly representative of the UK working population spanning diverse occupational classifications drawn out from each organisation. Figure 1 shows the results of the adjusted vacancy durations and the pooled average vacancy duration for the period 2007 to 2011. After adjusting for the proportion of jobs in each classification at the national level and the additional 4 weeks period for recruitment and training before taking on the vacancy, the adjusted vacancy duration for this period ranged from 2 months to 3.2 months. The pooled average friction period was 2.7 months (Figure 1).

Insert Figure 1 here

The data are then presented by occupational classification with some notable variations (Tables I to IV; Figure II). The data showed that variations were observed in the friction period estimates between the occupational classifications in the exploratory primary data collection exercise dataset (range: 2.5 (elementary profession) to 5.6 (senior managers); Table IV) and in the CIPD dataset (range: 1.5 (elementary profession) to 4.2 (senior managers); Table II) datasets. Relatively less variation in friction periods was observed across the different occupational classification categories in the other two datasets (Tables I and III). These data, however, mask the variability in the findings as limited summary data were available from most of the data sources (Tables II, III, IV) with the exception of the DLA Piper dataset (Table I) that had limited data on medians, lower quartile and upper quartile ranges. The pooled average duration of a friction period from three data sources stratified by occupational classifications is presented in Figure II, ranging from 4.1 months in managers and senior officials to 2.1 months in elementary occupations).

Insert Tables I, II, III, IV, Figure II here

4. DISCUSSION

As the desire to incorporate productivity costs within economic evaluation increases in various settings (Krol et al., 2015), there is the need for more precise and accurate estimates to be generated for the different approaches. For estimating friction costs, relevant and reliable data are required to generate friction periods for the practical application of the friction cost approach. In this study we provide detailed estimates of vacancy durations, and hence friction periods that can be applied within a UK setting.

This study highlights potential sources of routine friction period data for researchers within the UK. The pooled average duration of a friction period incorporating all data sources was 2.7 months with wide variations in the friction period across occupational categories from the four organisations (ranging from 1.5 to 5.6 months). This variation shows the need to further assess the impact of using stratified friction period estimates in economic evaluation studies that apply this approach to estimating productivity costs. Our analysis of vacancy duration data reveals a clear association between friction periods and occupation. Friction periods varied between occupational classifications and were higher in senior occupational roles than in lower level occupations such as skilled, services and elementary workers. This variation of friction periods by occupation in our results may possibly be explained by various reasons. It might be difficult to recruit highly trained senior level occupational workers. Higher level occupational category jobs such as senior managers generally have a smaller pool of individuals to choose from, resulting in prolonged recruitment periods compared to lower category occupational jobs. An alternative suggestion, which seems reasonable, is that unobserved factors such as potential consequences associated with unsuitable recruitments at the senior level, as well as stricter requirements for employees at this level can also prolong the time it takes to fill the vacancy. In addition, once identified, such employees require longer notice to leave periods for their employees. Indeed, an exploratory exercise as part of this research from the UoB data showed higher job notice period estimates of six to twelve weeks for this category of employees. Overall, the findings in this research are consistent with results of van Ours and Ridder (1991) and DeVaro (2005) who found increased vacancy durations in highly paid jobs and jobs requiring highly educated individuals.

Economic evaluations using friction period estimates have been very limited to date within the UK. These have reported a friction period of about 90 days (Maniadakis and Gray, 2000)

and 180 days (Lewis et al., 2007) without clear information on the source of these estimates. Internationally, few researchers have studied vacancy durations or provided detailed estimates of vacancy duration (Beaumont, 1978; Roper, 1988; van Ours and Ridder, 1991; Erdogan-Ciftci and Koopmanschap, 2011). A conference abstract reported estimated vacancy durations in 2009 for the Netherlands, Belgium, Germany, France, the UK, Norway and Sweden as ranging between 40-80 days using a combination of national aggregate stock and time series data on vacancies (Erdogan-Ciftci and Koopmanschap, 2011) but no further details were provided. The findings within this research show that the average friction period is broadly similar to these existing estimates, but provides a stronger basis for using such estimates in the UK, as well as more detailed information across different occupations.

An important finding is that if friction periods differ according to occupational levels as has been shown by the vacancy duration estimates presented here, then the current practice of using a single friction period for the labour market could potentially have an impact on estimates of overall friction related costs and on overall cost-effectiveness estimates.

The nature of the datasets provides one limitation that should be considered in interpreting the results. Data were obtained from different sources using different collection methods and only limited summary data were available for most of these datasets. This restricted the possibility of generating more detailed information such as standard deviations and other measures of dispersion. Despite this limitation, some important implications can be drawn for this research. Firstly, this work provides the best current estimates of friction periods for the UK. Secondly, it is clear that few attempts have been made at generating friction period estimates in different country settings. This research contributes to this area by highlighting possible sources of vacancy durations and illustrates how researchers from different country settings can generate friction periods from routine data.

5. CONCLUSION

Economic evaluations that have applied the friction cost approach outside the Netherlands context are scarce, in contrast to the theoretical interest in, and associated advantages of, this method. In part, this may be because of a lack of appropriate data in estimating key parameters such as the friction period. The analysis here reports a pooled friction period estimate for the UK of 2.7 months, and shows that the friction period is correlated to occupational classification. These findings provide the most-up-to-date estimates to guide future economic evaluations and research in the application of the friction cost approach in the UK.

REFERENCES

Adams, J., M. Greig, et al. (2002). "Mismatch in Local Labour Markets in Central Scotland: The Neglected Role of Demand." *Urban Studies.* 39(8): 1399-1416.

Andrews, M. J., S. Bradley, et al. (2008). "Successful Employer Search? An Empirical Analysis of Vacancy Duration Using Micro Data." *Economica* 75(299): 455-480.

Beaumont, P. B. (1978). "The duration of registered vacancies: an exploratory exercise." *Scottish Journal of Political Economy.* 25(1): 75-87.

Brouwer, W. B. F. and M. A. Koopmanschap (2005). "The friction-cost method - Replacement for nothing and leisure for free?" *Pharmacoeconomics* .23(2): 105-111.

CIPD (2007). "CIPD. Annual Survey report. Available at: http://www.cipd.co.uk/NR/rdonlyres/746F1183-3941-4E6A-9EF6-135C29AE22C9/0/recruitretntsurv07.pdf."

CIPD (2008). "CIPD. Annual Survey report. Recruitment, retention and turn over. Available at: http://www.cipd.co.uk/NR/rdonlyres/BE3C57BF-91FF-4AD0-9656-FAC27E5398AA/0/recruitmentretentionturnover2008.pdf."

CIPD (2009). "CIPD. Annual Survey report. Recruitment, retention and turn over. Available at: http://www.cipd.co.uk/hr-resources/survey-reports/recruitment-retention-turnover-2009.aspx."

DeVaro, J. (2005), "Employer Recruitment Strategies and the Labor Market Outcomes of New Hires", Economic Inquiry 43, 263–282.

DLA PIPER (2012). DLA PIPER HR benchmarker.Vacancy duration and medical statistics report to the University of Birmingham, Health Economics Unit. .

Erdogan-Ciftci, E. and M. Koopmanschap (2011). Estimation of productivity costs using the friction cost method: new evidence using national data. *Value in Health*. Volume 14, Issue 7, November 2011, Pages A235–A236

Hanly, P., M. Koopmanschap, et al. (2015). "Valuing productivity costs in a changing macroeconomic environment: the estimation of colorectal cancer productivity costs using the friction cost approach." *Eur J Health Econ*. DOI 10.1007/s10198-015-0698-5.

Kigozi, J., S. Jowett, et al. (2016). "Estimating productivity costs using the friction cost approach in practice: a systematic review." *Eur J Health Econ*. 17(1): 31-44.

Koopmanschap, M. and F. Rutten (1996). "A practical guide for calculating indirect costs of disease." Pharmacoeconomics 10: 460 - 466.

Koopmanschap, M. and B. van Ineveld (1992). "Towards a new approach for estimating indirect costs of disease." Soc Sci Med. 34: 1005 - 1010.

Koopmanschap, M. A., F. F. Rutten, et al. (1995). "The friction cost method for measuring indirect costs of disease." J Health Econ. 14(2): 171-189.

Krol, M., J. Papenburg, et al. (2015). "A noticeable difference? Productivity costs related to paid and unpaid work in economic evaluations on expensive drugs." *Eur J Health Econ*. DOI 10.1007/s10198-015-0685-x.

Lewis, M., M. James, et al. (2007). "An economic evaluation of three physiotherapy treatments for non-specific neck disorders alongside a randomized trial." *Rheumatology (Oxford).* 46(11): 1701-1708.

Liljas, B. (1998). "How to calculate indirect costs in economic evaluations." *Pharmacoeconomics*. 13(1 Pt 1): 1-7.

Maniadakis, N. and A. Gray (2000). "The economic burden of back pain in the UK." *Pain*. 84(1): 95-103.

Pritchard, C. and M. Sculpher (2000). Productivity Costs: Principles and Practise in Economic Evaluation. *Office of Health Economics*. London.

Roper, S. (1988). "Recruitment methods and vacancy duration." *Scottish Journal of Political Economy*. 35(1): 51-64.

Sculpher, M., Ed. (2001). The role and estimation of productivity costs in economic evaluation; in: Drummond MF, McGuire A (eds): Economic evaluation in health care: merging theory with practice. *Oxford University Press*: Oxford.

Van Ours, J. and G. Ridder (1991). "Cyclical variation in vacancy durations and vacancy flows: An empirical analysis." *European Economic Review*. 35(5): 1143-1155.

Table I: Friction period estimates for UK in months (number), by occupational level, for 2009-2011 (DLA Piper dataset)

Year	Occupational Classification Average (median; LQ - UQ)		
	ALL	1	2
2009	2.3 (2.0;1.5-1.8)	2.6 (2.3;1.5-3.1)	1.9 (1.5;1.2-1.8)
2010	2.2 (2.0;1.4-2.7)	2.6 (2.4;1.6-3.1)	2.0 (1.7;1.3-2.3)
2011	2.3 (2.0;1.5-2.7)	2.5 (2.3;1.5-3.1)	2.0 (1.7;1.3-2.4)
Unadjusted values	2.2 (2.0;1.5-2.4)	2.5 (2.3;1.5-3.1)	1.9 (1.6;1.2-2.1)
Adjusted for national UK vacancy values	2.0	2.6	2.0
Overall adjusted*	3.0	3.6	3.0

ALL. All employees,

1. Managerial/Professional,

2. Operational/Support

* Includes average duration of one month for time taken for an individual to start work

Table II: Friction period estimates for UK in months (number), by occupational level, for 2007-2009 (CIPD)

Year	Occupational classification Average(n)				
	1	2	3	4	5
2007	4.1 (761)	3.2 (814)	1.7 (797)	1.9 (678)	1.5 (611)
2008	4.1 (723)	3.0 (733)	1.7 (737)	1.9 (670)	1.5 (642)
2009	4.3 (703)	3.1 (720)	1.6 (717)	1.8 (657)	1.5 (633)
ALL	4.2	3.1	1.7	1.9	1.5
Adjusted for national UK vacancy values	4.2	3.1	1.7	1.9	1.5

1. Managerial and Senior official Occupations
2. Professional and Technical Occupations
3. Administrative and Secretarial Occupations
4. Service Occupations
5. Elementary Occupations

Table III: Friction period estimates for UK in months, by occupational level, for 2007-2011 (Based on vacancies filled by job centre plus and alternative recruitment channels) (ONS)

Year	Occupational level (Average)				
	1	2	3	4	5
2007	1.6	1.7	1.4	1.9	1.4
2008	1.6	1.9	1.4	1.8	1.4
2009	2.0	1.8	1.2	1.7	1.2
2010	1.4	1.5	1.2	1.6	1.3
2011	1.3	1.4	1.2	1.5	1.2
ALL	1.6	1.7	1.3	1.7	1.3
Adjusted for national UK vacancy values	1.6	1.7	1.3	1.7	1.3
Adjusted Overall*	2.6	2.7	2.3	2.7	2.3

1: Managerial and Senior official Occupations

2: Professional and Technical Occupations

3: Administrative and Secretarial Occupations

4: Service Occupations

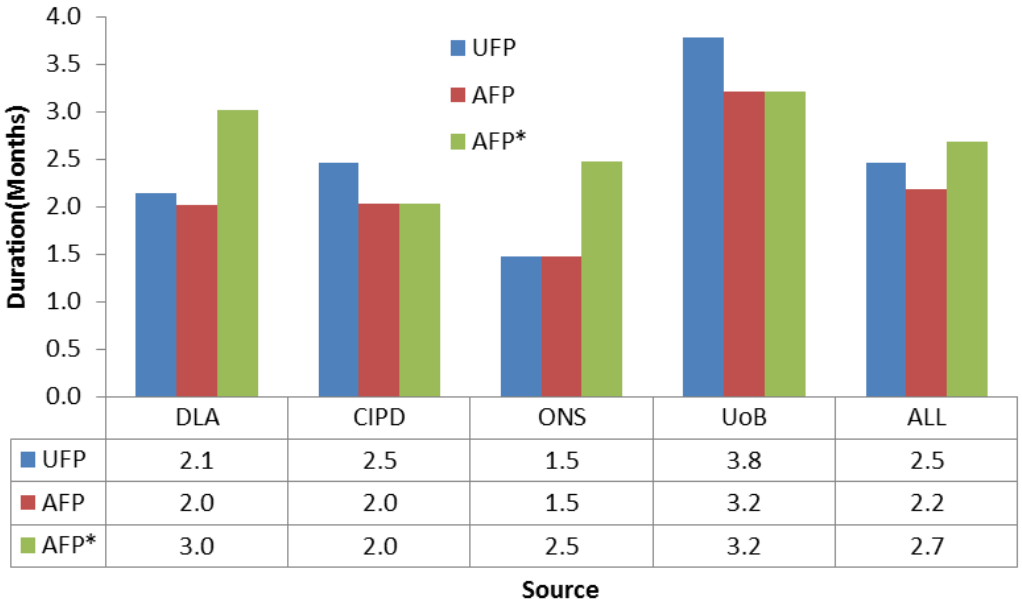
5: Elementary Occupations

* Includes average duration of one month for time taken for an individual to start work

Table IV: Estimated friction period in months, by occupational level, for 2009-2011 (Based on vacancies filled by the University of Birmingham, UK) (UoB).

Year	Occupational Classification (average)				
	1	2	3	4	5
2009	5.0	3.9	2.9	2.9	2.1
2010	6.6	5.2	3.2	2.9	2.3
2011	6.0	4.3	3.0	2.4	3.0
ALL	5.8	4.4	3.0	2.7	2.5
Adjusted for national UK vacancy values	5.6	4.5	3.0	2.7	2.5

1. Managerial and Senior official Occupations
2. Professional and Technical Occupations
3. Administrative and Secretarial occupations
4. Service Occupations
5. Elementary Occupations



	DLA	CIPD	ONS	UoB	ALL
UFP	2.1	2.5	1.5	3.8	2.5
AFP	2.0	2.0	1.5	3.2	2.2
AFP*	3.0	2.0	2.5	3.2	2.7

Figure 1: All organisations – Summary of friction period estimates for UK in months (number), by occupational level

DLA - DLA Piper LLP consultancy firm

CIPD Chartered institute for Professional Development

ONS Office of National Statistics

UoB - University of Birmingham, UK

ALL - Average of all organisations

UFP – Unadjusted friction period, AFP Friction period adjusted for national vacancy stocks by occupation, AFP* Friction period adjusted for national vacancy stocks by occupation and duration to take up job vacancy for DLA and ONS.

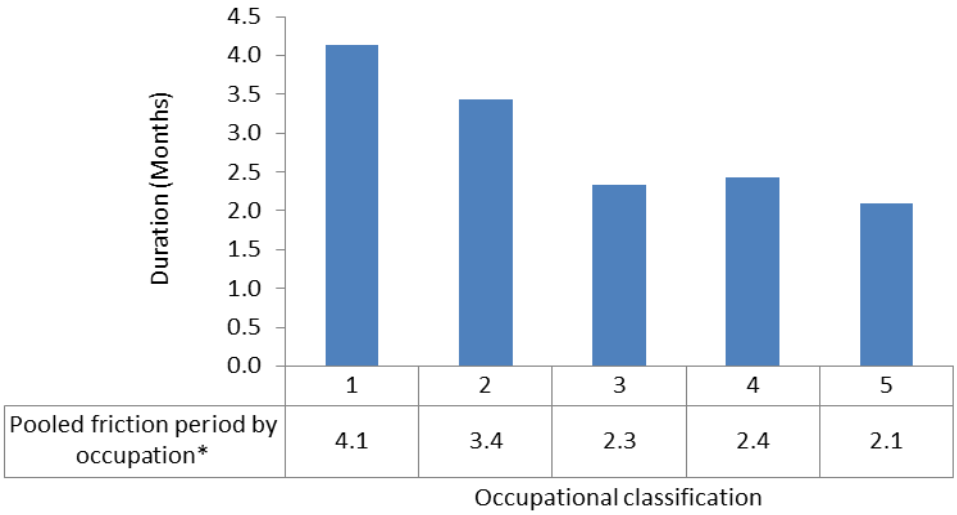


Figure 2: Average friction period estimates for the UK, by occupational classifications

* Occupational classification stratified pooled dataset based on Chartered institute for Professional Development (CIPD), Office of National Statistics (ONS), and University of Birmingham, UK (UoB) datasets.

1. Managerial and Senior official Occupations
2. Professional and Technical Occupations
3. Administrative and Secretarial Occupations
4. Service Occupations
5. Elementary Occupations